

Earthquake generated water waves on uniformly sloping coasts

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Abstract. The response of water surface to seismic ground motion is investigated where the sloping sea bottom acts like a wavemaker with an oblique piston. The generation of the water wave is defined as a potential flow problem and solved analytically in two-dimensional polar coordinates. Closed-form expressions are derived to describe the velocity potential and the free surface displacement. Both functions depend on the ground velocity and an amplitude response factor which is controlled by the water depth, seismic frequency, and gravitational acceleration. The analytical solution for the water surface displacement is applied to strong motion data measured during the 1999 Kocaeli Earthquake in the Izmit Bay Area. Discrete Fourier transformation is used to determine the component frequencies and the associated amplitudes of the seismic wave. The maximum water wave amplitudes in the Izmit Bay are computed between 0.8 and 1.3 m for measured ground displacements with 2-m amplitudes.

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